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A STUDY OF DDT DEPOSITS ON PEACH FOLIAGE AND FRUIT
TREATED FOR CONTROL OF THE ORIENTAL FRUIT MOTH

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In the use of DDT for the control of the oriental fruit moth (Grapholitha molesta (Busck)), applications are generally made only during a period of about 6 weeks prior to harvest. It seemed likely that the amounts of DDT needed to protect the fruit during this period would give harvest residues in excess of the administrative tolerance of 7 p.p.m. for apples and pears. Therefore, in 1948 studies were made of the deposits on peach foliage and fruit following different methods and schedules of application, including their effectiveness in controlling the oriental fruit moth. The results of these studies are especially opportune because of the recent hearings by the Food and Drug Administration to establish a definite legal tolerance for DDT residues on fruits. The toxicological investigations reported by Lehman (2) suggest that 5 p.p.m. approaches the maximum amount of DDT that could safely be allowed in any single food item.

The orchards in which the studies were made are located between Marlton and Florence, N. J. The varieties Summercrest and Elberta were used in the spray experiments and the variety Afterglow in the dust experiments. The average ripening dates in this vicinity are August 21 for Summercrest, August 25 for Elberta, and August 29 for Afterglow. The owners of the orchards applied the usual lead arsenate sprays for control of the plum curculio (Conotrachelus nenuphar (Hbst.)) and sulfur sprays or dusts for brown rot control.

Methods

Sprays were applied to plots of trees in six orchards. Each plot, including the check, consisted of four trees, two corresponding trees in each of two adjacent rows. Five plots in each orchard were treated

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according to the same spray schedules. No plot was adjacent to another receiving the same treatment, and the plots were usually separated by two rows of buffer trees, in some cases by only one. The sprays were applied with a conventional power sprayer, some at a pressure of 300 pounds per square inch with a No. 7 orifice disk and others at 400 pounds with a No. 5 orifice disk in a spray gun.

The spray schedules planned included applications at 2-week intervals with the last application 2 weeks before harvest in one schedule, and at 3-week intervals with the last application 3 weeks before harvest in all others. Spray dates were predetermined in accordance with the average ripening date of the varieties on which observations were to be made. In some cases unfavorable weather lengthened the intervals to approximately 3-1/2 weeks. There were also slight variations from the planned intervals between the last application and harvest, because ripening dates varied from the averages. The schedules that were ultimately followed, including single applications for comparative purposes, are shown in the tables. All sprays contained 2 pounds of 50-percent DDT wettable powder per 100 gallons.

In two orchards a 5-percent DDT dust was applied. Each plot consisted of 10 consecutive trees in a row. Ten corresponding trees separated from the treated trees by a buffer row were used as checks. The dust schedule planned was 3 applications 2 weeks apart, the last application 2 weeks before harvest. There were some variations due to unfavorable weather and fruit ripening earlier than expected. The dates of application are shown in the tables. Dusts were applied with a rotary hand duster at the rate of approximately 1/2 pound per tree.

In five orchards triplicate samples of 50 leaves each were obtained for residue analyses immediately after each application, and at weekly intervals thereafter until the next application or harvest. The samples from the sprayed plots each consisted of 10 leaves from the trees in each of 5 plots; those from the dusted plots of 5 leaves from each of the 10 trees in the plots. Each leaf was placed in a pint fruit jar immediately after its removal from the tree to prevent the loss of DDT deposit. The DDT was removed from the leaves by extracting with 125 ml. of a 2:1 mixture of benzene and isopropanol for 5 minutes on a tumbling machine. The DDT in a 100-ml. aliquant was determined by the total-chlorine method described by Koblitsky and Chisholm (1). The results from the triplicate samples were averaged. The average area of 50 peach leaves taken at random was found to be about 1,300 sq. cm. (one surface only).

Fruit samples for analysis were obtained from the sprayed trees immediately before harvest by taking 5 fruits from each of the 5 plots. In the dusted trees a sample of 25 fruits was obtained at random from each plot. The sample fruits were placed in paper shopping bags as soon as they were removed from the trees. They were weighed at the laboratory, then transferred to 2-1/2 gallon jars and extracted on a

tumbling machine for 5 minutes with 500 ml. of the benzene-isopropanol mixture. The extract was dried with anhydrous sodium sulfate and the amount of DDT in a 400-ml. aliquant was determined by the total-chlorine method.

The oriental fruit moth infestation in the fruit at harvesttime was determined on samples of 200 fruits, 10 taken from each tree in the sprayed plots and check and 200 at random from each dusted plot and check. The fruits were cut and examined for larvae or signs of larval feeding soon after the samples were obtained.

Results

Residues on leaves (table 1). --The residues on leaves from nine initial spray applications averaged 11.1 micrograms per square centimeter. About 70 percent of the initial residue was lost during the week after the first application; very little more was lost during the second and third week. When DDT was applied in repeated sprays, the residues increased a little with each application.

About four-fifths of the residues from the initial dust applications was lost during the first week; there was a further loss during the second week. Additional dust applications did not cause increases above the initial deposit.

Residues on ripe fruit (table 2). --The amount of DDT on the sprayed fruit at harvesttime apparently depended on the schedule. These residues exceeded 7 p.p.m. in only two of nine treatments in which two or three sprays were applied at intervals of 3 or 3-1/2 weeks. There was more than 7 p.p.m. of DDT on the fruit in all plots in which three sprays were applied at 2-week intervals. Harvest residues on the fruit dusted three times at 2-week intervals were only 4 p.p.m. in both orchards. For the most part there seemed to be no clear-cut relationship between the interval between the last spray and harvesttime and the residue on the fruit.

Relationship of DDT residue and schedule of application to ripe fruit infestation. --In the sprayed orchards the best control of the oriental fruit moth was obtained with the treatments that gave the highest harvest residues, and the reduction in infestation was less than 80 percent where the residue was less than 7 p.p.m. Furthermore, the control was usually best in the plots in which the DDT residues on leaves had been heaviest for approximately 6 weeks prior to harvest.

When three sprays were applied at 2-week intervals, fruit infestation was reduced by an average of 80 percent. Three sprays applied at 3- or 3-1/2-week intervals were 14 percent more effective than two sprays applied at the same intervals. The reduction in fruit infestation averaged 64 percent as a result of six treatments in which two sprays were applied at approximately 3- or 3-1/2-week intervals, and 52 percent as a result of three treatments in which one spray was applied 18 days before harvest.

Three applications of DDT dust, 2 weeks apart, were relatively ineffective in controlling the oriental fruit moth.

The DDT residues on leaves during the third week after spray applications appeared to be considerably less effective in reducing larval populations than the residue present during the second week after applications as indicated by a comparison of the 2- and 3-week schedules.

Literature Cited

- (1) Koblitsky, L., and Chisholm, R. D.
1949. The determination of DDT in soil. Assoc. Off. Agr. Chem. Jour. 32: 781-786.
- (2) Lehman, A. J.
1949. Pharmacological considerations of insecticides. Assoc. Food and Drug Off. Bul. 13: 65-70.

Table 1.--DDT residues on leaves from peach trees in orchards sprayed or dusted for control of the oriental fruit moth

Schedule	Application date	Orchard No.	Micrograms of DDT per square centimeter found on indicated date															
<u>Sprays</u>																		
1	June 21, July 12, and Aug. 2	{ 1 2	June 22	June 28	July 6	July 10	July 13	July 19	July 26	July 30	Aug. 3	Aug. 9	Aug. 16	Aug. 23				
			13	4	2	3	7	4	4	3	11	4	6	5				
			16	5	3	3	11	5	4	4	14	6	5	5				
			Av. 14.5	4.5	2.5	3	9	4.5	4	3.5	12.5	5	5.5	5				
1A	June 21, July 13, and Aug. 6	3	14	4	2	2	14	4	7	--	14	9	7	6				
2	July 9 and 23, Aug. 6	{ 1 2 3	July 10 July 16 July 22 July 23 July 30 Aug. 6-7 Aug. 7 Aug. 13 Aug. 20-21															
			--	--	--	9	3	3	9	4	4	13	12	6				
			--	--	--	9	3	3	12	5	3	16	11	10				
			--	--	--	10	4	6	12	--	6	14	9	8				
					Av. 9.3	3.3	4	11	4.5	4.3	14.3	10.7	8	8				
3	July 12, Aug. 2	{ 1 2	July 13 July 19 July 26 July 30 Aug. 3 Aug. 9 Aug. 16 Aug. 23															
			--	--	--	--	8	3	2	2	10	3	6	4				
			--	--	--	--	8	3	3	3	13	5	4	4				
						Av. 8	3	2.5	2.5	2.5	11.5	4	5	4				
3A	July 13, Aug. 6	3	--	--	--	--	13	3	6	--	13	11	6	6				
<u>Dusts</u>																		
	July 19, Aug. 2, and Aug. 17	{ 4 5	July 19 July 26 July 30 Aug. 2 Aug. 9 Aug. 16 Aug. 17 Aug. 23 Aug. 30															
			--	--	--	16	2	1	5	1	1	9	3	3				
			--	--	--	8	3	2	4	1	1	5	2	1				
						Av. 12	2.5	1.5	4.5	1	1	7	2.5	2				

Table 2. --DDT residues on fruit at harvesttime and infestation in orchards sprayed or dusted for control of the oriental fruit moth

Schedule	Application dates	Orchard No.	Application interval	Time between last application and harvest	DDT on fruit	Reduction of infestation	Infestation in untreated peaches
<u>Sprays</u>							
1	June 21, July 12, and Aug. 2	{ 1 2	3 3	21 22	7 6	75 52	68 62
1A	June 21, July 13, and Aug. 6	3	3, 3-1/2	11	10	66	25
2	July 9 and 23, Aug. 6	{ 1 2 3	2 2 2	17 17 11	10 9 8	82 62 96	68 62 25
3	July 12, Aug. 2	{ 1 2	3 3	21 22	4 4	65 27	68 62
3A	July 13, Aug. 6	{ 3 6 7	3-1/2 3-1/2 3-1/2	11 18 18	6 9 7	58 82 81	25 19 78
4	July 12, Aug. 2	8	3	18	4	72	46
5	Aug. 6 2	{ 6 7 8	- - -	18 18 18	6 4 2	66 54 35	19 78 46
<u>Dusts</u>							
	July 19, Aug. 2, and Aug. 17	{ 4 5	2 2	13 13	4 4	42 0	53 14